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Rapid Communication

First record of Asian *Cardamine occulta* Hornem. (Brassicaceae) in Poland

Artur Pliszko

Department of Taxonomy, Phytogeography and Palaeobotany, Institute of Botany, Faculty of Biology, Jagiellonian University, Gronostajowa 3, 30-387 Kraków, Poland

E-mail: *artur.pliszko@uj.edu.pl*

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Abstract

Cardamine occulta is an annual or biennial plant native to Eastern Asia. It was introduced to Europe in the second half of the 20th century. So far, it was recorded in 16 European countries, usually in anthropogenic habitats of urban areas. Abundant populations of *C. occulta* have been found in the surroundings of Lake Constance in Germany, Austria, and Switzerland. In this study, I present the first record of *C. occulta* in Poland. It was found in two stands in the city of Kraków, southern Poland, in November 2019, growing in a flower bed and flower ponds. The distribution of the species is mapped using the ATPOL cartogram grid and its status in Poland is briefly discussed.

Key words: casual alien species, Central Europe, plant invasion, urban areas, weeds

Introduction

Cardamine occulta Hornem., an annual or biennial plant of Brassicaceae, is native to Eastern Asia (Marhold et al. 2016). It is an octoploid species ($2n = 8x = 64$) that probably originated by natural hybridization between the tetraploids *C. scutata* Thunb. and *C. kokaiensis* Yahara, Soejima, Kudoh, Šlenker & Marhold (Mandáková et al. 2019). According to Lihová et al. (2006) and Marhold et al. (2016), the evolutionary origin and successful spread of *C. occulta* have been connected with the establishment of irrigated man-made habitats such as rice paddies and orchards. It was introduced to North and Central America, Europe, Australia, New Zealand and Hawaii (Mandáková et al. 2019 and references therein). The main path of the introduction of *C. occulta* is horticulture. It is accidentally introduced as a weed of ornamental and edible plants, often with potting soil in the containers, from plant nurseries and greenhouses (Marhold et al. 2016; Dzhus 2019; Leostrin and Mayorov 2019). It is usually found in urban areas, growing in flower beds and pots, on roadsides, among cobblestones or paving stones, or on pavements, lawns, often in irrigated places (Marhold et al. 2016; Leostrin and Mayorov 2019). It was also recorded in rice fields in northern Italy (Marhold et al. 2016). According to Marhold et al. (2016), *C. occulta* is quickly spreading from its area of origin in Eastern Asia to

other continents and represents an invasive species. Interestingly, the species can spread in natural habitats in Europe. Abundant populations of *C. occulta* have been found in the surroundings of Lake Constance in Germany, Austria, and Switzerland (Bleeker et al. 2008). Also, Simons and Jansen (2018) documented the spontaneous occurrence of *C. occulta* at the shore of the River Meuse in the Netherlands.

The earliest European records of *C. occulta* were made in 1968 in Belgium and in 1977 in Italy (Verloove 2018; Šlenker et al. 2019). However, for a long time (up to 2004) it was unrecognized in European floras and confused with *C. flexuosa* With. and *C. hirsuta* L. (Bleeker et al. 2008; Marhold et al. 2016; Verloove 2018; Dzhus 2019). *Cardamine occulta* can be distinguished from *C. flexuosa* and *C. hirsuta* by the lack of a rosette of basal leaves, by its almost glabrous stem (except the lower part of the stem which is sometimes sparsely hirsute), by its glabrous upper side of the leaf (except a few hairs on the edge of the leaf blade), and by its short (2.5–4.0 mm) and glabrous fruiting pedicels (Cooke and Heathcote 2017; Leostrin and Mayorov 2019). So far, it has been recorded in 16 European countries: Austria, Belarus, Belgium, France, Germany, Greece, Italy, Slovakia, Spain, Sweden, Switzerland, the Czech Republic, the European part of Russia, the Netherlands, the United Kingdom, and Turkey (Marhold et al. 2016; Cooke and Heathcote 2017; Šlenker et al. 2018; Dzhus 2019; Leostrin and Mayorov 2019). In this paper, I present the first record of *C. occulta* in Poland.

Materials and methods

Field surveys were conducted in the selected areas of the city of Kraków, southern Poland, in 2019. The purpose of the field surveys was to find *Cardamine occulta*. Identification of the species was based on morphological features provided by Cooke and Heathcote (2017), Šlenker et al. (2018), and Leostrin and Mayorov (2019). Herbarium specimens are deposited at the Herbarium of the Institute of Botany of the Jagiellonian University in Kraków (KRA 0529539, 0529545, 0529546). The distribution map of *C. occulta* in Poland was prepared using the ATPOL cartogram method, where the basic unit is a square of 10 km side (Zając 1978).

Results and discussion

Cardamine occulta was found in two stands in the city of Kraków, Lesser Poland Province, southern Poland. The first stand was discovered in a flower bed (greenery belt) at Krowoderska Street (coordinates: 50°04.309′N; 19°55.985′E; elevation: 206 m a.s.l. and 50°04.239′N; 19°56.094′E; elevation: 207 m a.s.l.), on 13 November 2019 and the second stand in two neglected flower pots at Warszawska Street near the building of the Cracow University of Technology (coordinates: 50°04.288′N; 19°56.664′E; elevation: 230 m a.s.l.), on 17 November 2019. Both stands are located within the unit DF69 of the

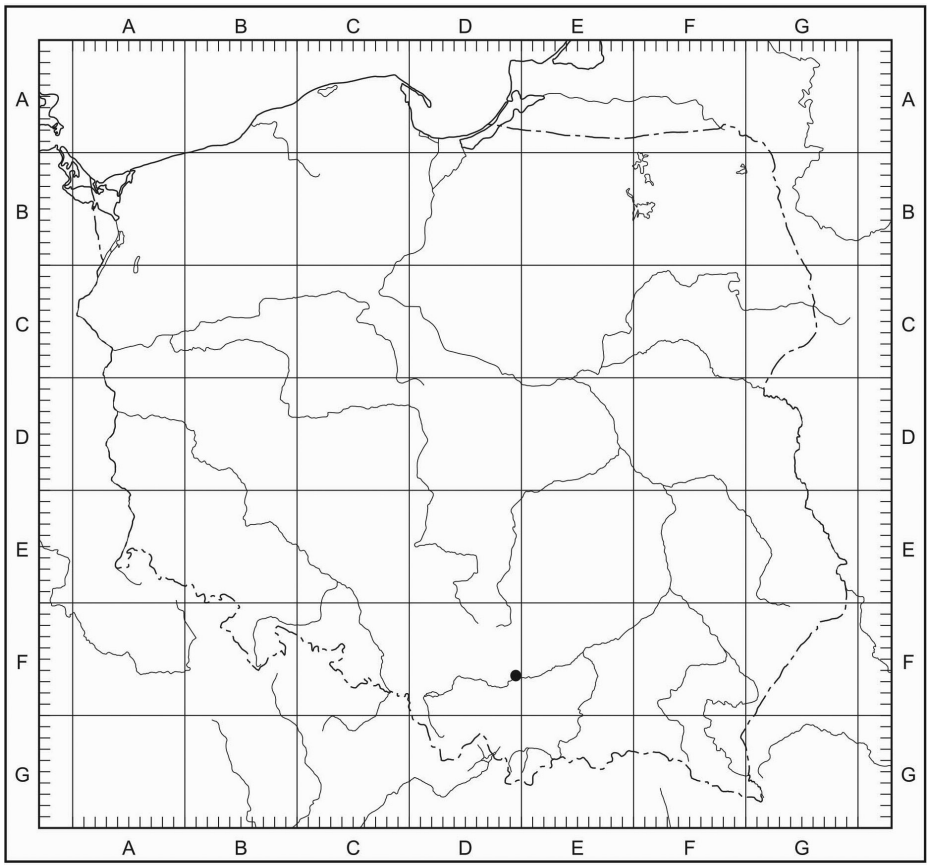

Figure 1. Distribution map of *Cardamine occulta* in Poland within the ATPOL square grid system.

ATPOL grid (Figure 1). The first stand consisted of three mature specimens whereas the second stand consisted of several mature specimens and numerous seedlings. Herbarium sheet with the mature specimen of *C. occulta* is presented in Figure 2. At the first stand, *C. occulta* was associated with *Capsella bursa-pastoris* (L.) Medik., *Epilobium* L. sp., *Erigeron annuus* (L.) Desf. s.str., *Galinsoga quadriradiata* Ruiz & Pav., *Poa annua* L., *Sonchus oleraceus* L., *Stellaria media* (L.) Vill., *Taraxacum* F.H. Wigg. sp. and seedlings of *Acer pseudoplatanus* L. At the second stand, it grew together with *Eragrostis minor* Host, *Erigeron canadensis* L., *Galinsoga parviflora* Cav., *Stellaria media*, and *Vicia* L. sp. The above-mentioned species are often found in ruderal habitats.

The occurrence of *C. occulta* as a weed of flower beds and pots has been observed in many cities in Europe, e.g. Graz in Austria, Florence and Pavia in Italy, Bratislava in Slovakia, San Vicente del Raspeig in Spain (Marhold et al. 2016), Moscow, St. Petersburg, Uglich and Vologda in Russia (Leostrin and Mayorov 2019), and Minsk in Belarus (Dzhus 2019). In regularly irrigated and fertilized flower beds and pots *C. occulta* grows fast and produces the seeds which can be easily dispersed by humans and animals to other anthropogenic habitats such as pavements, lawns, roadsides, and ditches (Marhold et al. 2016; Leostrin and Mayorov 2019). However, the regular weeding of flower beds and pots by urban greenery workers and gardeners may impede the persistence and further spread of *C. occulta*.

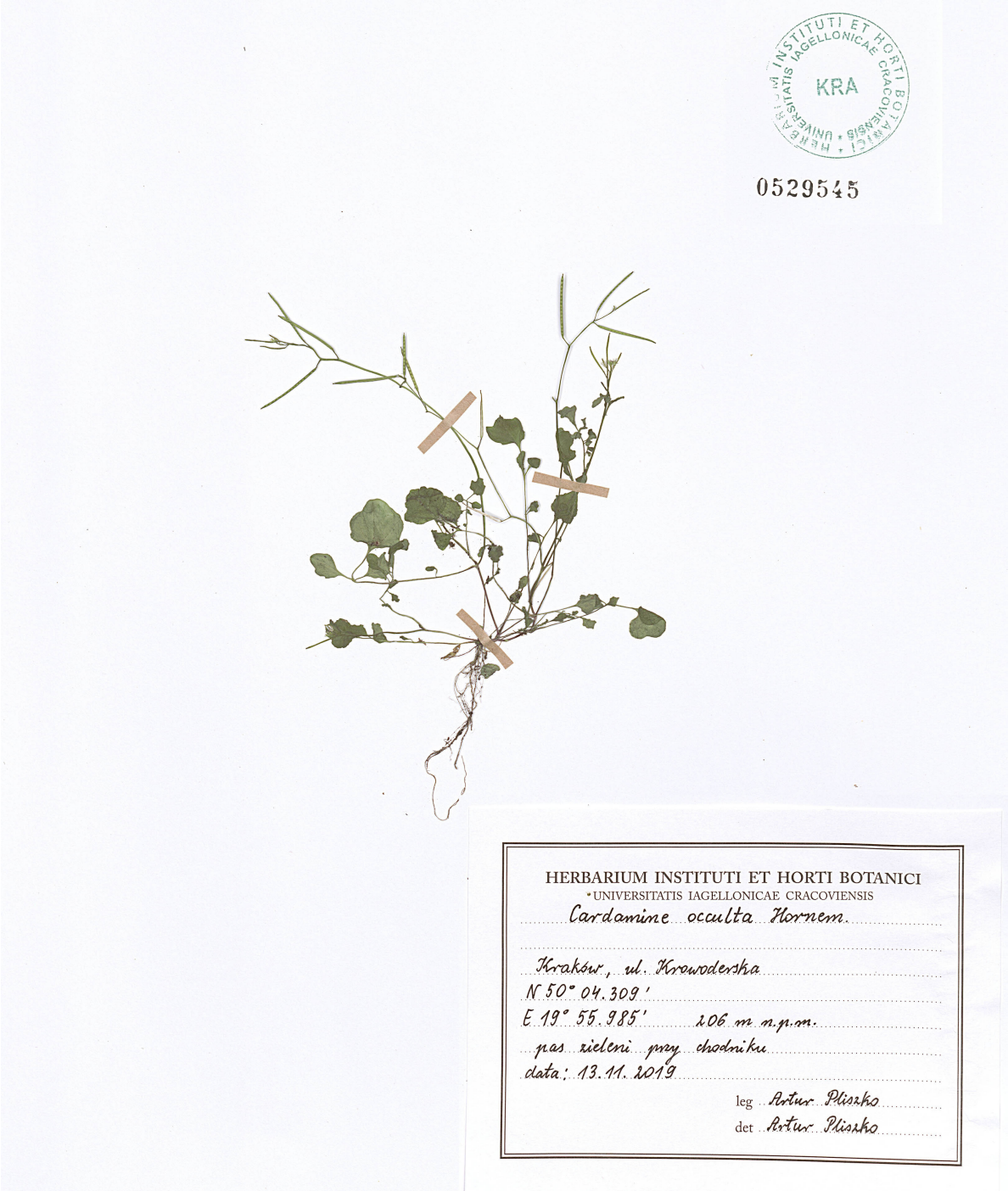

Figure 2. Herbarium specimen of *Cardamine occulta* from Poland deposited at KRA.

In Poland, *C. chelidonia* L. is the only alien species of *Cardamine* L. reported so far (Tokarska-Guzik et al. 2012). *Cardamine occulta* is the second alien species of this genus in the country. Currently, I consider that it should be treated as a casual alien species, following the criteria proposed by Pyšek et al. (2004). However, there is a probability that the species is naturalized in Poland but overlooked. Therefore, floristic surveys and revision of herbarium specimens based on careful identification of *Cardamine* species (especially of *C. flexuosa* and *C. hirsuta* collected in anthropogenic habitats), are recommended. I expect it to be a weed of

urban areas and its abundant occurrence in flower beds and pots may negatively affect the growth of some cultivated ornamental plants. The spread of *C. occulta* in wet arable fields is also expected. Moreover, considering the data presented by Bleeker et al. (2008) and Simons and Jansen (2018) it has a potential to be established in natural vegetation of lake and river shores and may pose a threat to native species of the *Phragmitetea* and *Bidentetea tripartitae* communities. Finally, I would like to encourage botanists to look for *C. occulta* in Poland and other European countries for better recognition of its geographical distribution, population abundance and impact on native biodiversity.

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References

Bleeker W, Klausmeyer S, Peintinger M, Dienst M (2008) DNA sequences identify invasive alien *Cardamine* at Lake Constance. *Biological Conservation* 141: 692–698, https://doi.org/10.1016/j.biocon.2007.12.015

Cooke EL, Heathcote SJ (2017) *Cardamine occulta*, another small white-flowered weedy brassica. *BSBI News* 135: 73–74

Dzhus MA (2019) *Cardamine occulta* Hornem. - a new alien small flowered bittercress (*Cardamine* L., Brassicaceae) of the Belarusian flora. *Journal of the Belarusian State University, Biology* 2: 82–88, https://doi.org/10.33581/2521-1722-2019-2-82-88

Leostrin AV, Mayorov SR (2019) Current state and distribution of alien weedy *Cardamine occulta* Hornem. (Brassicaceae) in European Russia. *Russian Journal of Biological Invasions* 10: 236–245, https://doi.org/10.1134/S207511171903007X

Lihová J, Marhold K, Kudoh H, Koch MA (2006) Worldwide phylogeny and biogeography of *Cardamine flexuosa* (Brassicaceae) and its relatives. *American Journal of Botany* 93: 1206–1221, https://doi.org/10.3732/ajb.93.8.1206

Mandáková T, Zozomová-Lihová J, Kudoh H, Zhao Y, Lysak M, Marhold K (2019) The story of promiscuous crucifers: origin and genome evolution of an invasive species, *Cardamine occulta* (Brassicaceae), and its relatives. *Annales of Botany* 124: 209–220, https://doi.org/10.1093/aob/mcz019

Marhold K, Šlenker M, Kudoh H, Zozomová-Lihová J (2016) *Cardamine occulta*, the correct species name for invasive Asian plants previously classified as *C. flexuosa*, and its occurrence in Europe. *PhytoKeys* 62: 57–72, https://doi.org/10.3897/phytokeys.62.7865

Pyšek P, Richardson DM, Rejmánek M, Webster GL, Williamson M, Kirschner J (2004) Alien plants in checklists and floras: towards better communication between taxonomists and ecologists. *Taxon* 53: 131–143, https://doi.org/10.2307/4135498

Simons ELAN, Jansen MGM (2018) Ecology of naturalized invasive species *Lindernia dubia* (L.) Pennell in the Netherlands. *Gorteria - Dutch Botanical Archives* 40: 001–010

Šlenker M, Zozomová-Lihová J, Mandáková T, Kudoh H, Zhao Y, Soejima A, Yahara T, Skokanová K, Španiel S, Marhold K (2018) Morphology and genome size of the widespread weed *Cardamine occulta* - how it differs from *C. kokaiensis* and other closely related taxa in Europe and Asia. *Botanical Journal of the Linnean Society* 187: 456–482, https://doi.org/10.1093/botlinnean/boy030

Šlenker M, Zozomová-Lihová J, Marhold K (2019) *Cardamine occulta* - inconspicuous neophyte in Slovakia. *Bulletin Slovenskej Botanickej Společnosti* 41(1): 13–23

Tokarska-Guzik B, Dajdok Z, Zając M, Zając A, Urbisz A, Danielewicz W, Hołdyński C (2012) Rośliny obcego pochodzenia w Polsce ze szczególnym uwzględnieniem gatunków inwazyjnych. Generalna Dyrekcja Ochrony Środowiska, Warszawa, 197 pp

Verloove F (2018) *Cardamine occulta*. Manual of the alien plants of Belgium. http://alienplants belgium.be/content/cardamine-occulta (accessed 05 February 2020)

Zając A (1978) Atlas of distribution of vascular plants in Poland (ATPOL). *Taxon* 27: 481–484, https://doi.org/10.2307/1219899